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(71) Applicant: RANPAK CORP. [US/US]; 8023 Crile Road, Concord, OH 44077 (US).

(72) Inventors: SIMMONS, James, A.; 340 Fanwood Drive, Painesville Township, OH 44077 (US). RATZEL, Richard, O.; 1751 Taylor's Mill Turn, Westlake, OH 44145 (US). BEIERLORZER, Edwin, P.; 4714 161st Avenue, S.E., Bellevue, WA 98006 (US).

(74) Agent: CAMPBELL, Jay, R.; Renner, Otto, Boisselle & Sklar, 19th floor, 1621 Euclid Avenue, Cleveland, OH 44115 (US).

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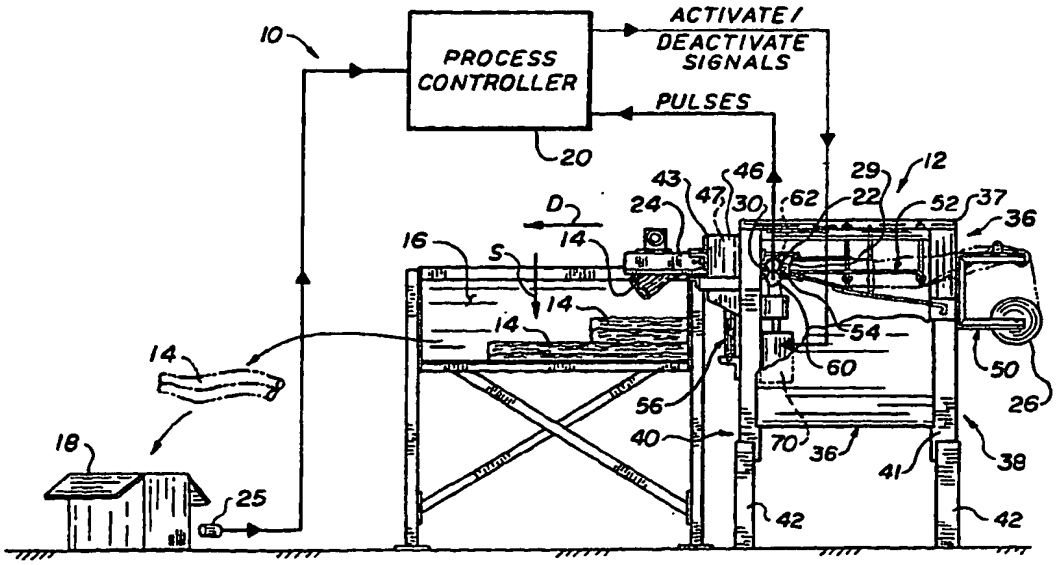
(54) Title: A PACKAGING PROGRAM



(57) Abstract

A packaging program (10) includes a cushioning conversion machine (12) which converts a stock material into a cushioning product or pad (14), a transitional zone (16) and a process controller (20) which controls the number of pads produced and their respective lengths. The cushioning conversion machine may include a length measuring device (22) for accurately measuring the length of a pad being produced and a pad-transferring assembly (24) for transferring the pads from the conversion assemblies (50, 52, 54, 56) of the cushioning conversion machine to the transitional zone. The transitional zone may be a slide with its slide direction oriented perpendicular to the discharge direction of the cushioning conversion machine to conserve space and orderly arrange the produced pads.

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TITLE: A PACKAGING PROGRAM

FIELD OF THE INVENTION

This invention relates generally as indicated to a packaging program and, more particularly to a packaging program including a cushioning conversion machine with a length measuring device and a pad-transferring device for transferring a pad of a desired length produced by the cushioning conversion machine to a transitional slide.

BACKGROUND AND SUMMARY OF THE INVENTION

In the process of shipping an item from one location to another, a protective packaging material is typically placed in the shipping container to fill any voids and/or to cushion the item during the shipping process. Some commonly used protective packaging materials are plastic foam peanuts and plastic bubble pack. While these conventional plastic materials seem to perform adequately as cushioning products, they are not without disadvantages. Perhaps the most serious drawback of plastic bubble wrap and/or plastic foam peanuts is their effect on our environment. Quite simply, these plastic packaging materials are not biodegradable and thus they cannot avoid further multiplying our planet's already critical waste disposal problems. The non-biodegradability of these packaging materials has become increasingly important in light of many industries adopting more progressive policies in terms of environmental responsibility.

These and other disadvantages of conventional plastic packaging materials have made paper protective packaging material a very popular alterative. Paper is biodegradable, recyclable and renewable; making it an environmentally responsible choice for conscientious companies.

While paper in sheet form could possibly be used as a protective packaging material, it is usually preferable to convert the sheets of paper into a low density cushioning product. This conversion may be accomplished by a cushioning conversion machine, such as those disclosed in U.S. Patent Nos. 4,026,198; 4,085,662; 4,109,040; 4,237,776; 4,557,716; 4,650,456; 4,717,613; 4,750,896; and 4,968,291. (These patents are all assigned to the assignee of the present

invention and their entire disclosures are hereby incorporated by reference.) Such a cushioning conversion machine converts sheet-like stock material, such as paper in multi-ply form, into low density cushioning pads.

A cushioning conversion machine, such as those disclosed in the above-identified patents, may include a stock supply assembly, a forming assembly, a gear assembly, and a cutting assembly, all of which are mounted on the machine's frame. During operation of such a cushioning conversion machine, the stock supply assembly supplies the stock material to the forming assembly. The forming assembly causes inward rolling of the lateral edges of the sheet-like stock material to form a continuous strip having lateral pillow-like portions and a thin central band. The gear assembly pulls the stock material through the machine and also coins the central band of the continuous strip to form a coined strip. The coined strip travels downstream to the cutting assembly which cuts the coined strip into pads of a desired length.

In the above-discussed cushioning conversion machines (and, in fact, in most cushion-creating machines), the cushioning products are discharged in a predetermined discharge direction through an exit in the machine's frame. Typically, the cushioning products are discharged to a transitional zone and then, at the appropriate time, inserted into a container for cushioning purposes.

In the past, a variety of arrangements have been used as transitional zones in packaging systems. For example, temporary receptacles (*i.e.*, bins) have been placed adjacent the machine's exit so that the cushioning products can be discharged therein to form a pile. At the appropriate time, the packaging person would reach into the transitional receptacle, retrieve a cushioning product from the accumulated pile, return to his/her workstation and then insert the cushioning product in the container.

Additionally, horizontal packaging surfaces (*i.e.*, tables) have been employed as transitional zones. Specifically, the horizontal surface is positioned so that the cushioning products are deposited thereon. When a packaging need arises, the packaging person picks up the cushioning product from the transitional surface and then, if the transitional surface also functions as a workstation, immediately inserts the cushioning product in the container.

Applicant is also aware that a "slide" has been used as a transitional zone for a cushion-creating machine. Specifically, this slide consisted of a semi-cylindrical conduit having a width just slightly greater than the width of the cushioning products. The slide was positioned adjacent to the machine so that its top portion was proximate to the machine's exit whereby the discharged cushioning products would be deposited thereon. Additionally, the slide was oriented relative to the machine so that it was longitudinally aligned with the product direction discharge. (In other words, the slide direction was a continuation of the machine's discharge direction.) In this manner, the discharged cushioning products stacked end-to-end in the conduit and, at the appropriate time, the bottom pad would be removed and used for cushioning purposes.

These and other transitional zones have all performed quite successfully in a variety of packaging systems and applicant expects they will continue to do so in the future. However, a certain packaging situation has recently arisen which has some special transitional needs. Particularly, this packaging situation requires a transitional zone which can accommodate pads of substantial lengths (*i.e.*, up to four feet), which presents the pads in an orderly sequential fashion, which occupies a minimal amount of space, and which maximizes packaging efficiency.

None of the above-discussed transitional zones appears to be capable of satisfying all four of these transitional requirements. Specifically, a temporary receptacle (*i.e.*, a bin) will not present the pads in an orderly fashion because they are simply accumulated in a pile. Moreover, most "space-conserving" forms of receptacles require a packaging person to bend over to retrieve a cushioning product. While a transitional horizontal surface (*i.e.*, a table) may be designed to eliminate the need for a packaging person to bend over, the pads will still be accumulated in a pile and may even fall off the surface in a high volume situation.

Regarding the transitional "slide" described above, it would appear to present the pads in an orderly, sequential fashion. However, it would have to be at least eight feet long to accommodate two four feet pads, and at least sixteen feet long to accommodate four of such pads. Consequently, such a slide would occupy a significant amount of space at the packaging site, especially if the outlet of the slide was positioned at a convenient height (*i.e.*, waist level). Moreover, the cushion-

creating machine would have to be substantially elevated so that its exit was positioned adjacent the top portion of the slide.

In the past, the transitional zone has been positioned beneath the cutting assembly whereby gravity caused the pad to fall towards the transitional zone, or, in other words, away from the cutting assembly. Additionally or alternatively, the approaching coined strip would urge the cut pad in this direction.

The practice of depending upon the force of gravity and/or the urging of the approaching strip for pad-transferring purposes has, for the most part, been very successful. Nevertheless, applicant appreciated that in certain circumstances (such as high/constant volume cushioning situations), pad-transfer problems sometimes, albeit very rarely, occurred. For example, because of the lightweight nature of the pad, one would occasionally fail to travel downstream to the transitional zone. While, in most instances, the approaching pads would eradicate this failure by pushing the "stalled" pad downstream, periodically the approaching pads would instead "shingle" (*i.e.*, the pads would stack one on top of the other in a shingle-like arrangement). Such shingling (although itself uncommon) would usually result in the "jamming" the cushioning conversion machine and this jamming would almost always translate into machine downtime.

With particular reference to the gear assembly, it includes loosely meshed gears between which the unconnected strip travels. The drive gear is fixedly mounted to a rotating shaft which is coupled to a motor. During operation of the machine, the gear motor rotates the shaft (and thus the drive gear) in an appropriate direction whereby the central band of the strip is grabbed by the gear teeth and pulled downstream through the nips of the gears. Thus, the gear assembly is a rotating conversion assembly which determines the production rate of the coined strip and, therefore, the cushioning products, or pads. (This "grabbing" simultaneously coins the layers of the central band together to form the coined strip.)

By selectively controlling the gear assembly (*i.e.*, by activating/deactivating its motor) and the cutting assembly, a cushioning conversion machine can create pads of a variety of lengths. This feature is important because it allows a single machine to satisfy a wide range of cushioning needs. For example, relatively short

pad lengths can be employed in connection with small and/or unbreakable articles, while longer pad lengths can employed in connection with larger and/or fragile articles. Moreover, a set of pads (either of the same or different lengths) can be employed in connection with uniquely shaped and/or delicate articles, such as electronic equipment.

Presently, a variety of length-controlling systems are used to control pad length. For example, a manual system is available in which a packaging person manually activates the gear assembly (*i.e.*, steps on a foot pedal) for a time period sufficient to produce a coined strip of the desired length. He/she then manually deactivates the gear assembly (*i.e.*, releases the foot pedal) and activates the cutting assembly (*i.e.*, pushes an appropriate button on the machine's control panel) to cut the coined strip. In this manner, a pad of the desired length is created. Alternatively, the system is designed so that a manual deactivation of the gear assembly (*i.e.*, release of the foot pedal) automatically activates the cutting assembly.

Another technique used to control pad length is a time-repeat system. In such a length-controlling system, a timer is electrically connected to the gear assembly. The timer is set for a period (*i.e.*, seconds) which, based on an estimated gear velocity, corresponds to the desired length of the pad. The time-repeat system is designed to automatically activate the gear assembly for the selected period and thereby, assuming the estimated gear velocity is correct and constant, produce a coined strip of the desired length. The system then deactivates the gear assembly and activates the cutting assembly to cut the coined strip into a first pad of the desired length. Thereafter, the system automatically re-activates the gear assembly to repeat the cycle so that, if the timer has not been reset, a multitude of pads of substantially the same length are continuously created.

A further available length-controlling system is a removal-triggered system. This system is similar to the time-repeat system in that it deactivates the gear assembly based on the setting of a timer. However, with the removal-triggered system, the gear assembly is not automatically reactivated. Instead, it is only re-activated when the cut pad is removed, either manually by the packaging person or

mechanically by a conveyor. Upon reactivation, another pad of the same length is produced unless the timer is reset.

Yet another length-controlling system includes a length-selection system which allows a packaging person to select certain predetermined pad lengths. In such a system, a selection panel (*e.g.*, a key pad) is provided with a plurality of length options (*e.g.*, buttons) so that a packaging person can manually select the appropriate pad length. When a particular length option is selected, the gear assembly is automatically activated for a period of time (based on estimated gear velocity) corresponding to the selected pad length. At the expiration of this time period, the gear assembly is deactivated, and the cutter assembly is activated. The process is then repeated and, unless another length option is manually selected, a subsequent pad of the same length is produced.

In many packaging situations, the production of a single pad length is sufficient to satisfy cushioning requirements and the above-discussed automatic controlling systems are usually compatible with these situations. For example, with a time-repeat system and/or a removal-triggered system, the packaging person manually sets the timer at a period corresponding to the desired length and a plurality of pads of this length are produced. Likewise, with a length-selection system, the packaging person manually selects the desired length option and a plurality of pads of the selected length are produced.

In other packaging situations, however, single pad length production is insufficient to satisfy cushioning requirements. For example, a series of identical packaging jobs may each require a set of pads of different lengths. Alternatively, a series of widely varying packaging jobs may each require a single pad, but each job may need a different sized pad. Also, a series of non-identical packaging jobs may each require a different set of pads of varying lengths.

The non-manual length controlling systems sometimes do not adequately accommodate these latter packaging situations. Specifically, in order to sequentially produce pads of different lengths, the timer on a time-repeat system and/or a removal-triggered system must be manually reset after each pad. Likewise, if a length-selection system is used, the packaging person must continuously manually change the length option. Thus, a high degree of interaction with the cushioning

conversion machine is necessary. Therefore, in order for a packaging person to properly interact with the machine, at least minimal training is necessary. Additionally, while the packaging person is interacting with the machine, he/she is not packaging thereby hindering the overall efficiency of the packaging program.

Regarding the manual length-controlling system, it can certainly be used to sequentially produce pads of different lengths. However, again, a high degree of interaction is necessary thereby requiring trained personnel and/or thereby hindering efficiency. Moreover, in both the manual and non-manual length-controlling systems, the packaging person must determine (either by experience or experiment) the appropriate pad length. For this additional reason, the use of untrained workers in sophisticated packaging situations is often impractical.

Accordingly, applicant appreciated that a more sophisticated packaging program was necessary to accommodate a full range of packaging situations, especially if untrained workers were to be used as packaging personnel. Additionally, applicant appreciated that a suitable program would automatically determine the cushioning needs of a certain box and would then automatically control the cushioning conversion machine to produce one or more pads of the appropriate length. With such a program, interaction (and thus training) would be minimal even with a series of non-identical packaging jobs which each require a different set of pads of varying lengths. Moreover, in even the simplest of packaging situations (*i.e.*, a single pad length situation) the pads for a particular box could be produced while the packaging person is packing the previous box thereby maximizing efficiency.

Applicant further appreciated that such a sophisticated packaging program could be accomplished with a process controller which, based on the packaging needs of a certain box, would control the gear assembly and the cutting assembly to produce pads of an appropriate length. In order to accomplish this control, however, the process controller needed to receive dimensional data (*i.e.*, length measurements) so that the control of the gear assembly and/or the cutting assembly could be properly coordinated. Applicant therefore developed the length measuring device of the present invention. The length measuring device may be used in conjunction with a process controller to create a sophisticated packaging

program. Specifically, the process controller could automatically determine the cushioning needs of a certain box and then, based on length measurements supplied by the length measuring device, automatically control the cushioning conversion machine to produce a cushioning product of the appropriate length.

More particularly, the present invention provides a cushioning conversion machine comprising conversion assemblies which convert a stock material into a cushioning product and a length measuring device which measures the length of the cushioning product as it is being produced. The conversion assemblies include a rotating conversion assembly and the angular movement of this assembly directly corresponds to the length of the cushioning product. In the preferred embodiment, the gear assembly is the rotating conversion assembly.

The length measuring device is positioned to monitor the angular movement of the rotating conversion assembly and thus the length of the cushioning products. Preferably, the length measuring device includes a rotating member and a monitor. The rotating member is attached to, and rotates with, the rotating conversion assembly and may comprise a disk with a series of openings arranged in equal circumferential increments. The monitor is positioned to monitor the angular motion of the rotating member (and thus the rotating conversion assembly) and it includes a photo-optic transmitter/receiver and a reflector. The transmitter/receiver is situated so that, as the rotating member turns, transmitted light beams will travel through its openings. The reflector is positioned to receive transmitted light beams which travel through the openings and to reflect these transmitted light beams back through the openings.

Thus, applicant's length measuring device is specifically designed to accommodate a sophisticated packaging program. Moreover, applicant's invention provides certain advantages over time-dependent systems, regardless of the sophistication of a packaging program. Specifically, in time-dependent systems, determinations are based on an estimated gear velocity. However, gear velocity has been known to deviate over the course of pad production, due to motor start-up lags, variations in stock material, the different strip profiles, and other factors. With applicant's length measuring device, these factors are irrelevant because determinations are based on the actual angular movement of the gear assembly.

Applicant also developed the pad-transferring assembly of the present invention to ensure that each and every pad is properly transferred to the transitional zone. Thus, in contrast to the conventional technique of depending upon the force of gravity and/or the urging of the approaching strip for pad-transferring purposes, applicant's invention provides a positive, mechanical means for transferring pads to the transitional zone.

More particularly, the present invention provides a cushioning conversion machine comprising conversion assemblies, a cutting assembly, and a pad-transferring assembly. The conversion assemblies are mounted to the machine's frame and convert the sheet-like stock material into a continuous strip of cushioning product. The cutting assembly is mounted to the frame downstream of the conversion assemblies and cuts a leading portion of the strip into a cut pad of a desired length. The pad-transferring assembly is mounted to the frame downstream of the cutting assembly and transfers the cut pad (formed when the strip is cut) away from the cutting assembly. Preferably, the pad-transferring assembly is a conveyor which frictionally engages the leading portion of the strip prior to it being cut and which frictionally transfers the cut pad away from the cutting assembly. More preferably, the conveyor engages the upper surface of the strip and the upper surface of the cut pad.

Applicant further developed a transitional zone which satisfies all four of these transitional requirements. Particularly, applicant's invention provides a packaging program comprising a cushion-creating machine and a slide positioned adjacent to the machine. The cushion-creating machine includes a frame and cushion-creating assemblies which are mounted to the frame and which create cushioning products. The machine's frame includes an exit through which the cushioning products are discharged in a predetermined discharge direction. The slide includes a smooth sloped surface with a top portion positioned proximate to the machine's exit so that the discharged cushioning products will be deposited thereon. The smooth sloped surface has a pitch angle which is sufficient to insure that cushioning products placed on the top portion of the surface will slide in a predetermined slide direction.

The smooth sloped surface is oriented relative to the machine in such a manner that the slide direction is substantially perpendicular to the discharge direction. This geometric relationship allows the cushioning products to stack in a consecutive side-by-side arrangement and thereby present the pads in an orderly sequential fashion.

These and other features of the invention are fully described and particularly pointed out in the claims. The following descriptive annexed drawings set forth in detail one illustrative embodiment, this embodiment being indicative of but one of the various ways in which the principles of the invention may be employed.

Brief Description Of The Drawings

In the annexed drawings:

Figure 1 is a schematic view of a packaging program, the program including a cushioning conversion machine incorporating a length measuring device, a pad-transferring assembly and a slide according to the present invention;

Figure 2 is a front view of the length measuring device and other relevant portions of the cushioning conversion machine;

Figure 3 is a side view of the length measuring device and other relevant portions of the cushioning conversion machine;

Figures 4A-4C are schematic views of the operation of the pad-transferring assembly;

Figure 5 is a top, isolated view of the pad-transferring assembly;

Figure 6 is a side, isolated view of the pad-transferring assembly;

Figure 7 is a front (downstream), isolated view of the pad-transferring assembly;

Figure 8 is a rear (upstream), isolated view of the pad-transferring assembly;

Figure 9 is a side view of the pad-transferring assembly, the assembly being shown mounted to the cushioning conversion machine by appropriate mounting members;

Figure 10 is a front (downstream) view of the pad-transferring assembly, the assembly being shown mounted to the cushioning conversion machine by appropriate mounting members;

Figure 11 is a perspective view of one component of the machine's frame and one of the mounting members;

Figure 12 is a front view of the slide; and

Figure 13 is a side view of the slide.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings in detail and initially to Figure 1, a sophisticated packaging program 10 according to the present invention is shown. The packaging program 10 includes a cushioning conversion machine 12 for creating low density cushioning pads 14, a transitional slide 16 for temporary storage of the pads prior to being placed into a box 18 as a packaging material, and a process controller 20 for controlling the cushioning conversion machine. The cushioning conversion machine includes a length measuring device 22 designed to determine length measurements of the pad 14 based on the actual angular movement of a rotating gear assembly, described below, and a pad-transferring assembly 24 for transferring pads from the cushioning conversion machine 12 to the slide 16. The process controller 20 automatically determines the packaging needs of a certain box 18, *i.e.*, by a bar code scanner 25, and then automatically controls the cushioning conversion machine 12 through the aid of the length measuring device 22 to produce the desired number of pads 14 of the appropriate length.

In Figure 1, the machine 12 is shown loaded with a roll of sheet-like stock material 26. The stock material 26 may consist of three superimposed webs of biodegradable, recyclable and reusable thirty-pound Kraft paper rolled onto a hollow cylindrical tube. The machine 12 converts this stock material into a continuous unconnected strip having lateral pillow-like portions separated by a thin central band. This strip is coined along its central band to form a coined strip which is cut into pads 14 of a desired length.

The machine 12 has a frame 36 which includes a self-standing portion 37 having an upstream end 38 and a downstream end 40, with conversion assemblies

mounted therebetween. (The terms "upstream" and "downstream" in this context are characteristic of the direction of flow of the stock material 26 through the machine 12.) In the illustrated embodiment, the frame portion 37 includes four legs 41 (only two of which are visible in the illustrated orientation). Additionally, in the illustrated embodiment, "stilts" 42 are provided so that the height of the machine 12 is appropriate for the transitional zone or slide 16. The frame 36 further comprises an extension 43 attached to the downstream end 40 of the self-standing frame portion 37. The extension 43 includes a horizontal shelf 44, and a casing 46 which, together with the shelf 44, forms a rectangular tunnel 47.

The conversion assemblies include a stock supply assembly 50, a forming assembly 52, a gear assembly 54, and a cutting assembly 56, all of which are mounted to the frame 36, and the pad-transferring assembly 24 mounted to the frame extension 43. Specifically, the stock supply assembly 50 is mounted to the upstream end 38 of the self-standing frame portion 37 of the frame 36; the forming assembly 52 is mounted on the frame portion 37 downstream of the stock supply assembly 50; and the gear assembly 54 is mounted on the frame portion 37 downstream of the forming assembly 52. The cutting assembly 56 is mounted on both the self-standing frame portion 37 and the frame extension 43, with its "cutting element" (*i.e*, its blade 57 which may be seen by referring briefly to Figure 9) being positioned within the tunnel 47. The pad-transferring assembly 24 is mounted to the frame extension 43 with a portion of the pad-transferring assembly positioned within the tunnel 47, just downstream of the cutting assembly 56 in order to engage the pad 14.

During operation of the machine 12, the stock supply assembly 50 supplies the stock material 26 to the forming assembly 52. The forming assembly 52 causes inward rolling of the lateral edges of the sheet-like stock material to form the lateral pillow-like portions of the continuous strip 29. The gear assembly 54 pulls the stock material downstream through the machine and also coins the central band of the continuous strip to form the coined strip 30. As the coined strip 30 travels downstream from the gear assembly 54, the cutting assembly 56 cuts the strip into pads 14 of a desired length. The pad-transferring assembly 24 frictionally engages

the leading portion of the coined strip prior to it being cut and then frictionally transfers the pad 14 (formed when the coined strip 30 is cut) to the slide 16.

With particular reference to the gear assembly 54, it includes a drive gear 60 and a loosely meshed idler gear 62. (See Figure 1.) The drive gear 60 is fixedly mounted to a shaft 66 which is rotatably mounted to the frame 36 by bearing structures 68. (See Figures 2 and 3.) As shown (but not specifically numbered) in Figure 1, a sprocket at one end of the shaft 66 accommodates a chain which connects the shaft to a motor 70.

During operation of the machine 12, the gear motor 70 rotates the drive shaft 66 (and thus the drive gear 60) in an appropriate direction whereby the central band of the strip is grabbed by the gear teeth and pulled downstream through the nips of the gears 60 and 62. (This "grabbing" simultaneously coins the layers of the central band together to form the coined strip 30.) Thus, the gear assembly 54 is a rotating conversion assembly and its angular movement directly corresponds to the length of the coined strip 30 and therefore the cushioning products, or pads, 14. In the preferred embodiment, one revolution of the drive gear 60 produces a coined strip which is approximately twelve inches, or one foot long. In other words, every 30° increment of angular movement by the drive gear 60 corresponds to one inch of the coined strip, or pad.

The length measuring device 22 is positioned to monitor the angular movement of the gear assembly 54. In the illustrated and preferred packaging program 10, angular motion data is sent to the process controller 20 to produce pads of appropriate lengths. For example, the bar code on the box 18 may indicate to the scanner 25 that the box requires three pads: a three foot pad, a one foot pad, and a six inch pad. To accommodate this packaging situation, the process controller 20 would activate the gear assembly 54 (*i.e.*, send an activation signal to the motor 70), and monitor the angular motion of the drive gear 60. Since the length measuring device 24 determines length measurements based on the actual angular movement of the drive gear 60, gear velocity (and the inaccuracies associated therewith) become irrelevant in length determinations. When the angular motion of the gear assembly 54 corresponded to three feet of cushioning product (three revolutions in the preferred embodiment), the process controller 20 would deactivate

the gear assembly 54 (*i.e.*, send a deactivation signal to the motor 70) and the cutter assembly 56 would be activated to cut the coined strip. This process would be repeated for the next two pads, except that the process controller 20 would deactivate the gear assembly 54 when its angular movement corresponded to a one foot pad length and a half-a-foot pad length, respectively (a full revolution and a half a revolution, respectively, in the preferred embodiment).

The length measuring device 22 includes a rotating member 80 which is attached to the gear shaft 66 and a monitor 82 which monitors the angular motion of the member 80, and thus the gear shaft 66. Preferably, the rotating member 80 is a disk with a series of openings 84 arranged in equal circumferential increments. More preferably, the rotating member 80 is a black, nonreflective, aluminum disk with twelve openings. In this manner, each opening 84 will correspond to a 30° angular movement and, in the preferred embodiment, one inch of pad length.

The monitor 82 comprises a photo-optic transmitter/ receiver 86 which transmits and receives light beams and a reflector 88 which reflects the transmitted light beams. The transmitter/receiver 86 is mounted on the machine frame portion 37 and is positioned so that, as the rotating member 80 turns, transmitted light beams will travel through the openings 84. A suitable photo-optic transmitter/receiver 86 is manufactured by Banner under the catalog number SM2A312LV. It may be noted for future reference that the photo-optic transmitter/receiver 86 includes electrical circuitry capable of relaying interruptions in the receipt of light beams.

The reflector 88 is likewise mounted on the frame portion 37, but is positioned to receive transmitted light beams which travel through the openings 84. A suitable reflector is manufactured by Opcon under catalog number 6202AXXXX.

As the rotating member 80 turns, light beams transmitted by the transmitter/receiver 86 will pass through a first opening 84, contact the reflector 88, and reflect back to the transmitter/receiver 86. Once this opening 84 rotates out of alignment with the transmitter/receiver 86 (and the reflector 88), the receipt of reflected light beams by the transmitter/receiver 86 will be interrupted until the next opening 84 moves into alignment. Thus, with the preferred rotating member 80,

twelve interruptions would occur for every revolution of the member 80, and thus for every revolution of the drive gear shaft 66.

The transmitter/receiver 86 relays the occurrence of an interruption to the process controller 11 in the form of a pulse. The process controller 20 uses this information to control the gear assembly 56 (*i.e.*, to send activation/deactivation signals to the motor 70) and thus uses this information to control pad lengths. For example, if the bar code on the box 18 indicated that a three foot pad was necessary, the process controller 20 would deactivate the preferred gear assembly 54 after thirty-six pulses were relayed. Likewise if a six inch pad was necessary, the process controller 20 would deactivate the preferred gear assembly 54 after six pulses were relayed.

The pad-transferring assembly 24 which transfers the pads after being formed in the appropriate lengths, is best shown in schematic illustrations 4A-4C. The pad-transferring assembly is designed to frictionally engage (or "grab") the leading end of the coined strip 30 prior to it being cut. (See Figure 4A.) As the coined strip 30 is being cut, the pad-transferring assembly 24 continues to frictionally engage the leading edge of the coined strip 30. (See Figure 4B.) Once the strip 30 is completely cut, and the cut pad 14 is created, the pad-transferring assembly 24 immediately transfers the cut pad 14 towards the transitional zone or slide 16, or, in other words, away from the cutting assembly 56. (See Figure 4C.) Preferably, and as shown, it is the upper surface of the strip 30 and the upper surface of the cut pad 14 which are frictionally engaged during the transferring process.

Referring now to Figures 5 through 8, the pad-transferring assembly 24 is illustrated isolated from the other assemblies of the machine 12. As shown, the pad-transferring assembly 24 comprises a support structure 90, a conveyor 92, a drive unit 94, a guide chute 96, and a series of coupling elements 98*a* - 98*l*.

The support structure 90 includes a top plate 100, two side plates 102, two guard plates 104, a motor-mounting plate 106, and a back-up plate 108. The top plate 100 is sized/shaped to cover the upper surface of the conveyor 92. (See Figure 5.) The side plates 102, which are attached to the lateral edges of the top plate 100 by capscrews 98*a*, are sized/shaped to cover the lateral surfaces of the

conveyor 92. It may be noted for future reference that each side plate 102 includes an open elongated slot 109. (See Figure 6.)

The guard plates 104 are attached to the upstream/downstream edges of the top plate 100 by capscrews 98*b* and they are sized/shaped to shield the space between the top plate 100 and the conveyor 92. (See Figure 5.) The motor-mounting plate 106 is attached to the upper surface of the top plate 100 by capscrews 98*c* and, as the name implies, it is sized/shaped to mount a motor. The back-up plate 108 is attached to the lower edges of the side plates 102 by capscrews 98*d*. (See Figures 6 and 7.) For ease in explanation, the description of the size, shape and purpose of the back-up plate 108 is presented below in connection with the conveyor 92.

The conveyor 92 includes a drive roller 110 non-rotatably mounted on a drive shaft 111 by setscrews 98*e*, an idler roller 112 rotatably mounted on an idler shaft 113 by bearings 98*f*, a take-up roller 114 rotatably mounted on a take-up shaft 115 by bearings 98*g*, and an endless belt 116 wrapped around the rollers 110, 112, and 114. The drive shaft 111 is rotatably mounted to the side plates 102 by bearings 98*h* and the idler shaft 113 is non-rotatably mounted to the side plates 102 by setscrews 98*i*. As is best seen in Figure 6, both ends of the take-up shaft 115 extend outwardly from the side plates 102 through the elongated slots 109 and the shaft 115 non-rotatably held this position, as is explained in more detail below. It may be noted for future reference that one end of the drive shaft 111 extends outwardly from a side plate 102. (See Figure 5.)

Returning now to the back-up support plate 108, it is positioned between the drive roller 110 and the idler roller 112, and just above the belt 116. (See Figure 6.) Accordingly, it is sized/shaped for this positioning. During operation of the conveyor 92, the back-up plate 108 provides an upper support surface for the endless belt 116.

The conveyor 92 may additionally comprise an adjustment mechanism 118 for selectively adjusting the tension and/or the longitudinal orientation of the belt 116. (Additionally, the mechanism 110, along with the belt 116, function to nonrotatably mount the take-up shaft 115 to the side plates 102.) The adjusting elements of the mechanism 118 are a pair of threaded rods 120 which interact with

the flattened ends of the take-up shaft 115 to adjust their point of insertion through the slots 109. The rods 120 extend through threaded bores in blocks 122 which are coupled to the side plates 102 by capscrews 98*j*. The threaded arrangement between the rods 120 and the blocks 122 allows controlled and concise adjustments by "screwing/unscrewing" the rods 120. (See Figures 5 and 6.)

The drive unit 94 includes a motor 124, which is mounted to the motor mounting plate 106 by capscrews 98*k* and thus is mounted to the top support plate 100. The drive unit 94 also includes components for transferring the rotational power of the motor 124 to the conveyor 92. More specifically, these components transfer rotational motion to the drive roller 110 which in turn rotates the conveyor belt 116, and thus, the idler roller 112 and the take-up roller in the appropriate direction. (In the orientation shown in Figure 6, this direction is clockwise.) The illustrated transfer components comprise a pulley 126 which is attached to the motor shaft, a pulley 127 which is attached to one end of the drive shaft 111 (i.e, the end which extends through the side plate 102), and a belt 128 wrapped around the pulleys 126 and 127. The drive unit 94 may additionally include a belt guard 129 to shield the motor belt 128 from external interferences.

The guide chute 96 comprises two tracks 130 (See Figures 5, 7 and 8) symmetrically positioned to form a bottomless channel below the conveyor 92 for the cut pads 14 to travel through during the transferring process. (It should be noted at this point that the "bottom" of the bottomless channel could be partially or totally covered if desirable for a particular application.) The tracks 130 each include a downstream section 132 and an upstream section 134, both sections having an "upside-down L" cross sectional geometry. Each track's downstream section 132 has uniform cross section geometry and each track's upstream section 134 is flared (both outwardly and upwardly) towards its upstream edge. (See Figures 7 and 8.) In this manner, the bottomless channel has a relatively wide entrance for the initial insertion of the leading edge of the coined strip 30 and/or the cut pad 14.

The guide chute 96 further comprises two vertical flanges 136, one for each track 130, which project from the top upstream edge of the track 130. The inner edges of the flanges 136 are coupled to the upstream edges of the side plates 102 by

capscrews 98*l* to thereby couple the guide chute 96 to the support structure 90. (See Figures 5 and 8.)

Referring now to Figures 9 through 11, the pad-transferring assembly 24 is shown mounted to the machine frame 36 or, more particularly, the tunnel-forming components 44 and 46 of the frame extension 37. This mounting is accomplished by a mounting plate 140, a top mounting bracket 142, a pair of bottom mounting brackets 144, and a series of coupling elements 146*a*-146*h*. Specifically, the mounting plate 140 is coupled to the machine frame 36, the top and bottom brackets 142 and 144 are coupled to mounting plate 140, and the top bracket 142 is coupled to the pad-transferring assembly 24. The top and bottom brackets 142 and 144 are also coupled to each other and are arranged so that the bottom brackets 144 can function as a braces for the top bracket 142.

The one-piece mounting plate 140 includes a horizontal mounting surface 150, a top vertical flange 152, and a pair of bottom vertical flanges 154. As is best seen in Figure 11, the mounting surface 150 is located on an inside surface of the end wall of the casing 46. The geometry of the mounting surface 150 is chosen to accommodate the coupling of the brackets 142 and 144 thereto and also to reinforce the casing 46, particularly its end wall. To this end, the mounting surface 150 includes a laterally-extending section 156 and two vertically-extending sections 158.

The laterally-extending section 156 extends downward from the top vertical flange 152. The two vertically-extending sections 158 extend between intermediate regions of the laterally-extending section 156 and the bottom vertical flanges 154. Specifically, the vertically-extending sections 158 are positioned adjacent the lateral edges of the casing's outlet opening. (See Figure 11.) As is best seen in Figure 10, the sections 156 and 158 may be coupled to the casing 46 by capscrews 146*a* and 146*b*, respectively.

The top vertical flange 152 is attached to the upper wall of the casing 46 by capscrews 146*c*. The bottom vertical flanges 154 project outwardly from the tunnel 47 and are attached to the upper surface of the shelf 44 by capscrews 146*d*. (See Figure .) Thus, capscrews 146*a* - 146*d* couple the mounting plate 140 to the machine frame 36. The top mounting bracket 142 has a "backwards L" sectional geometry and each of the bottom brackets 144 has an "upside-down L" sectional

geometry. (See Figure .) The top mounting bracket 142, which spans the distance between the two vertically-extending sections 158, is coupled to the laterally-extending section 156 (and also the casing 46) by capscrews 146*e* extending through the vertical leg of the bracket 142. (See Figure 10.) The bottom brackets 144 are of substantially the same width as the vertically-extending sections 158 and they are coupled thereto (and also the casing 46) by capscrews 146*f* extending through the bracket's horizontal legs. In this manner, the top and bottom brackets 142 and 144 are coupled to the mounting plate 140, and, consequently, to the machine frame 36. Preferably, vertically elongated slots are used in conjunction with the capscrews 146*e* and 146*f* for selective up/down adjustments of the brackets 142 and 144 (and thus the pad-transferring assembly 24) relative to the mounting plate 140 (and thus the tunnel 47 or the machine frame 36).

The top mounting bracket 142 is coupled to the top support plate 100 by capscrews 146*e* which extend through the bracket's horizontal leg. (Thus, the pad-transferring assembly 24 is hung in a cantilever fashion from the frame extension 43.) In this manner, the pad-transferring assembly 24 is coupled to the top mounting bracket 142 whereby it is coupled to the mounting plate 140 and therefore the machine frame 36.

As was indicated above, the top and bottom brackets 142 and 144 are coupled to each other and are arranged so that the bottom mounting brackets 144 can function as a braces for the top mounting bracket 142. Specifically, the brackets 142 and 144 are coupled to each other by capscrews 146*f* extending through their horizontal legs. (See Figure 10.) As is best seen in Figure 9, this arrangement allows the bottom brackets 144 to share the load of the cantilevered pad-transferring assembly 24.

The cushioning conversion machine 12 may further include a transitional ledge 160. The transition ledge 160 has an "upside-down L" cross sectional geometry, with its vertical leg being attached to the downstream edge of the shelf 44 by a capscrew 162. This attachment is accomplished so that the ledge's horizontal leg is flush with the upper surface of the shelf 44 and projects outwardly therefrom. In this manner, the transitional ledge 160 forms a smooth transition surface between the shelf 44 and the pad-transfer assembly 24. (See Figure 9.)

As the cut pad 14 emerges from the pad-transferring assembly 24 it enters the slide 26. The slide 16 provides a transitional zone which can accommodate pads 14 of substantial lengths, which presents the pads in an orderly sequential fashion, which occupies a minimal amount of space, and which maximizes packaging efficiency. The slide 16 includes a smooth sloped surface 170 positioned proximate to the exit of the machine 12 so that the discharged cushioning pads 14 will be deposited thereon. (See Figures 1 and 12.) The sloped surface 170 has a pitch angle α (see Figure 13) which is sufficient to ensure that cushioning pads 14 deposited on its top portion will slide in a predetermined slide direction *S* (see Figure 1). The pitch angle α is preferably between 25° and 35°, and, more preferably approximately 30°.

The smooth sloped surface 170 is oriented relative to the machine 12 in such a manner that the slide direction *S* is substantially perpendicular to the discharge direction *D*. (See Figure 1.) Additionally, the plane of the smooth sloped surface 170 is substantially parallel to the discharge direction *D*. This geometric relationship allows the cushioning products 14 to stack in a consecutive side-by-side arrangement and thereby present the pads in an orderly sequential fashion.

In the preferred embodiment, the slide 16 includes a tray 174, which incorporates the smooth sloped surface 170, and a support structure 176, which supports the tray 174 (and thus the smooth sloped surface 170) in the proper orientation. The tray 174 includes a bottom wall 178 and a set of side walls 180 which surround the bottom wall 178 and which extend perpendicularly upward therefrom. The upper surface of the bottom wall 178 forms the smooth sloped surface 170.

The tray 174 is preferably of a one-piece fabrication and is preferably made of stainless steel. More preferably, the tray 174 is made of #2B finish stainless steel which is annealed, pickled, and bright cold rolled. This material selection is based on the desire to optimize the "smoothness" of the sloped surface 174 so that the pads 14 will slide frictionlessly down it. The tray 174 is preferably left unpainted to further this objective.

In the preferred form of the tray 174, the bottom wall 178 (and thus the transitional surface 170) has a length *L* of approximately four feet and a width *W* of

approximately three feet. Thus, the transitional zone can accommodate pads of substantial lengths (*i.e.*, approximately four feet). The side walls 180 form a two to three inch border around the bottom wall 178 (and thus the transitional surface 170) so that the stacked pads 14 will be retained therein. The upper edges of the side walls 180 are rolled, and their corners seams are welded, so that tray 174 will be free of any burs or projections which could cause interference during the packaging process.

As was indicated above, the support structure 176 supports the tray 174, and therefore the smooth sloped surface 170, in the proper orientation. In this proper orientation, the height H_B of the bottom edge of the tray 174 is approximately thirty-six inches and the height H_U of the tray's upper edge is approximately fifty-four inches. This positions the bottom (or front) edge of the tray 174 at the waist level of most packaging personnel. In this manner, a packaging person can easily retrieve the cushioning products 14 from the transitional zone (*i.e.*, he/she does not have to bend over) thereby maximizing packaging efficiency.

The support structure 176 comprises a pair of front leg members 190, a pair of back leg members 192, a back brace member 194, and four side brace members 196. The particular design of the support structure 176 allows the slide 16 to occupy a minimal amount of space at the packaging site. Specifically, the slide 16 will occupy approximately 10½ square feet of floor space.

The support members 190, 192, 194, and 196 are all preferably made of steel and, more preferably, are all made of 11 gauge, 1½ inch square, tubular steel and painted to prevent rust. The front leg members 190 are attached (*e.g.*, bolted) to the front corners of the tray 174 and the back leg members 192 are attached (*e.g.*, bolted) to the back corners of the tray 174. In the preferred slide 16, the front leg members 190 are approximately 36½ inches long and the back leg members are approximately 52½ inches long. Additionally, the preferred leg members 190/192 include bottom mounting plates 198 which may be used for permanent installation of the slide 16 at the packaging site.

The back brace member 194 is "criss-cross" component which extends between the back leg members 192. (See Figure 12.) Preferably, a mounting plate 200 is attached (*e.g.*, welded) to each of the four distal ends of the back brace

member 194. In the assembly of the slide 16, the mounting plates 200 are attached (*e.g.*, bolted) to the back leg members 192.

The side brace members 196 are linear components which extend between aligned front/back leg members 190/192. Specifically, in the preferred embodiment, two brace members 196 are horizontally arranged on each lateral set of front/back members 190/192. (See Figure 13.) The ends of the side brace members 196 are preferably directly attached (*e.g.*, welded) to the leg members 190/192.

The positioning of the support members 190, 192, 194 and 196 relative to each other, and the attachment (*i.e.*, bolting v. welding) between these support members, allows the slide 16, when in an unassembled state, to be compactly shipped and/or stored. Particularly, the slide 16 disassembles into four substantially planar pieces: the tray 174, the back brace member 194, and the two sides of the support structure (*i.e.*, a front leg member 190, a back leg member 192, and two side brace members 196 coupling them together).

One may now appreciate that the present invention provides a length measuring device, a pad-transferring assembly and a transitional slide which may be used individually or together in conjunction with a sophisticated packaging program controlled by a process controller. Although the invention has been shown and described with respect to a certain preferred embodiment, it is obvious that equivalent alterations and modifications will occur to others skilled in the art upon the reading and understanding of this specification. The present invention includes all such equivalent alterations and modifications and is limited only by the scope of the following claims.

What is claimed is:

1. A packaging program comprising:

a cushioning conversion machine having a frame, conversion assemblies which are mounted to the frame and which convert a stock material into a cushioning product; and

a process controller for automatically determining the cushioning needs of a certain box and then automatically controlling the cushioning conversion machine to produce a cushioning product of the appropriate length.

2. A packaging program as set forth in claim 1, including a length measuring device which measures the length of the cushioning product as it is being produced.

3. A packaging program as set forth in claim 1, including a cutting assembly, mounted to the frame downstream of the conversion assemblies, which cut the cushioning product into a pad of a desired length; and

a pad-transferring assembly, mounted to the frame downstream of the cutting assembly, which transfers the cut pad away from the cutting assembly.

4. A packaging program as set forth in claim 1, wherein the machine's frame includes an exit through which the cushioning products are discharged in a predetermined discharge direction; and including a slide having a smooth sloped surface with a top portion positioned proximate to the machine's exit so that the discharged cushioning products will be deposited thereon; the smooth sloped surface having a pitch angle which is sufficient to insure that cushioning products placed on the top portion of the surface will slide in a predetermined slide direction; and the smooth sloped surface being oriented relative to the machine in such a manner that the slide direction is substantially perpendicular to the discharge direction.

5. A packaging program as set forth in claim 1, including a sensor for sensing the cushioning needs of a box, the sensor being coupled to the process controller for providing cushioning need information to the process controller.

6. A cushioning conversion machine comprising:

a frame,

conversion assemblies which are mounted to the frame and which convert a stock material into a cushioning product, and

a length measuring device which measures the length of the cushioning product as it is being produced;

the conversion assemblies including a rotating conversion assembly, the angular movement of this assembly directly corresponding to the length of the cushioning product,

the length measuring device being positioned to monitor the angular movement of the rotating conversion assembly and thus the length of the cushioning product.

7. A cushioning conversion machine as set forth in claim 6 wherein the length measuring device includes:

a rotating member which is attached to, and rotates with, the rotating conversion assembly; and

a monitor which monitors the angular motion of the rotating member, and thus the rotating conversion assembly.

8. A cushioning conversion machine as set forth in claim 7 wherein the rotating member comprises a disk with a series of openings arranged in equal circumferential increments.

9. A cushioning conversion machine as set forth in claim 7 wherein the monitor comprises a photo-optic transmitter/receiver which transmits and receives light beams and a reflector which reflects light beams;

the photo-optic transmitter/receiver being positioned so that, as the rotating member turns, transmitted light beams will travel through its openings;

the reflector being positioned to receive the transmitted light beams which travel through the openings and to reflect these transmitted light beams back through the openings.

10. A cushioning conversion machine as set forth in claim 6 wherein the conversion assemblies include:

a forming assembly which inwardly rolls the lateral edges of the sheet-like stock material to form a continuous strip having lateral pillow-like portions and a thin central band;

a stock supply assembly which supplies the sheet-like stock material to the forming assembly;

a gear assembly which pulls the stock material through the forming assembly and which coins the central band of the continuous strip to form a coined strip, the gear assembly being the rotating conversion assembly; and

a cutting assembly which cuts the coined strip into pads of a desired length.

11. A cushioning conversion machine comprising:

a frame having an upstream end and a downstream end;

conversion assemblies, mounted to the frame, which convert a sheet-like stock material into a continuous strip of a cushioning product;

a cutting assembly, mounted to the frame downstream of the conversion assemblies, which cuts a leading portion of the strip into a cut pad of a desired length; and

a pad-transferring assembly, mounted to the frame downstream of the cutting assembly, which transfers the cut pad away from the cutting assembly.

12. A cushioning conversion machine as set forth in claim 11 wherein the pad-transferring assembly engages the leading portion of the strip prior to it being cut.

13. A cushioning conversion machine as set forth in claim 11 wherein the pad-transferring assembly frictionally engages the strip prior to being cut and frictionally transfers the cut pad away from the cutting assembly.

14. A cushioning conversion machine as set forth in claim 11 wherein the pad-transferring assembly comprises a conveyor which frictionally engages the strip prior to it being cut and frictionally transfers the cut pad away from the cutting assembly.

15. A cushioning conversion machine as set forth in claim 11 further comprising a stock supply assembly which supplies the sheet-like stock material to the conversion assemblies and wherein the conversion assemblies comprise:

a forming assembly which converts the stock material into a continuous unconnected strip having lateral pillow-like portions separated by a thin central band; and

a gear assembly which coins the continuous unconnected strip along its central band to form a continuous coined strip.

16. A cushioning conversion machine comprising:

a frame having an upstream end and a downstream end;

conversion assemblies, mounted to the frame, which convert a sheet-like material into a cushioning product; and

a pad-transferring assembly, mounted to the frame downstream of the conversion assemblies, which transfers the cushioning product away from the conversion assemblies.

17. A packaging system comprising a cushion-creating machine and a slide positioned adjacent to the machine;

the cushion-creating machine including a frame and cushion-creating assemblies which are mounted to the frame and which create cushioning products;

the machine's frame including an exit through which the cushioning products are discharged in a predetermined discharge direction;

the slide including a smooth sloped surface with a top portion positioned proximate to the machine's exit so that the discharged cushioning products will be deposited thereon;

the smooth sloped surface having a pitch angle which is sufficient to insure that cushioning products placed on the top portion of the surface will slide in a predetermined slide direction; and

the smooth sloped surface being oriented relative to the machine in such a manner that the slide direction is substantially perpendicular to the discharge direction.

18. A packaging system as set forth in claim 17 wherein the slide includes a tray, which incorporates the smooth sloped surface, and a support structure, which supports the tray, and thus the smooth sloped surface.

19. A packaging system as set forth in claim 17 wherein the cushion-creating machine is a cushioning conversion machine which converts a sheet-like stock material into the cushioning products and which comprises:

a forming assembly which inwardly rolls the lateral edges of the sheet-like stock material to form a continuous strip having lateral pillow-like portions and a thin central band;

a stock supply assembly which supplies the sheet-like stock material to the forming assembly;

a gear assembly which pulls the stock material through the forming assembly and which coins the central band of the continuous strip to form a coined strip; and

a cutting assembly which cuts the coined strip into pads of a desired length.

20. A packaging system as set forth in claims 17 wherein the pitch angle is between 25° and 35°.

21. A packaging system comprising a cushion-creating machine and a slide;

the cushion-creating machine including a frame and cushion-creating assemblies which are mounted to the frame and which create cushioning products;

the machine's frame including an exit through which the cushioning products are discharged in a predetermined discharge direction;

the slide including a smooth sloped surface which is positioned in substantially one plane, a top portion of the surface being positioned adjacent to the machine's exit so that the discharged cushioning products will be deposited thereon; and

the slide being oriented relative to the machine in such a manner that the plane of the smooth sloped surface is substantially parallel to the discharge direction.

* * *

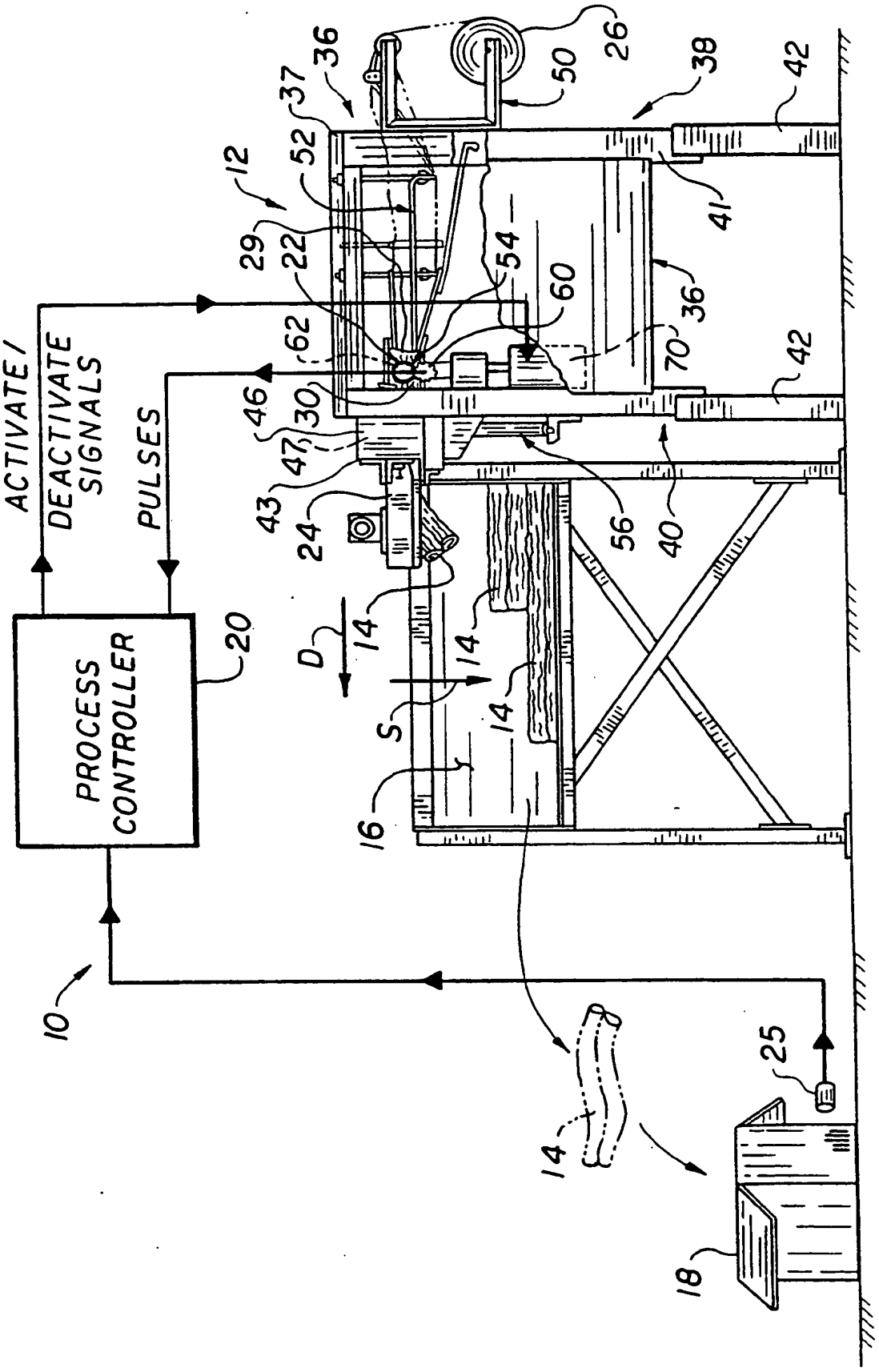


FIG. 1

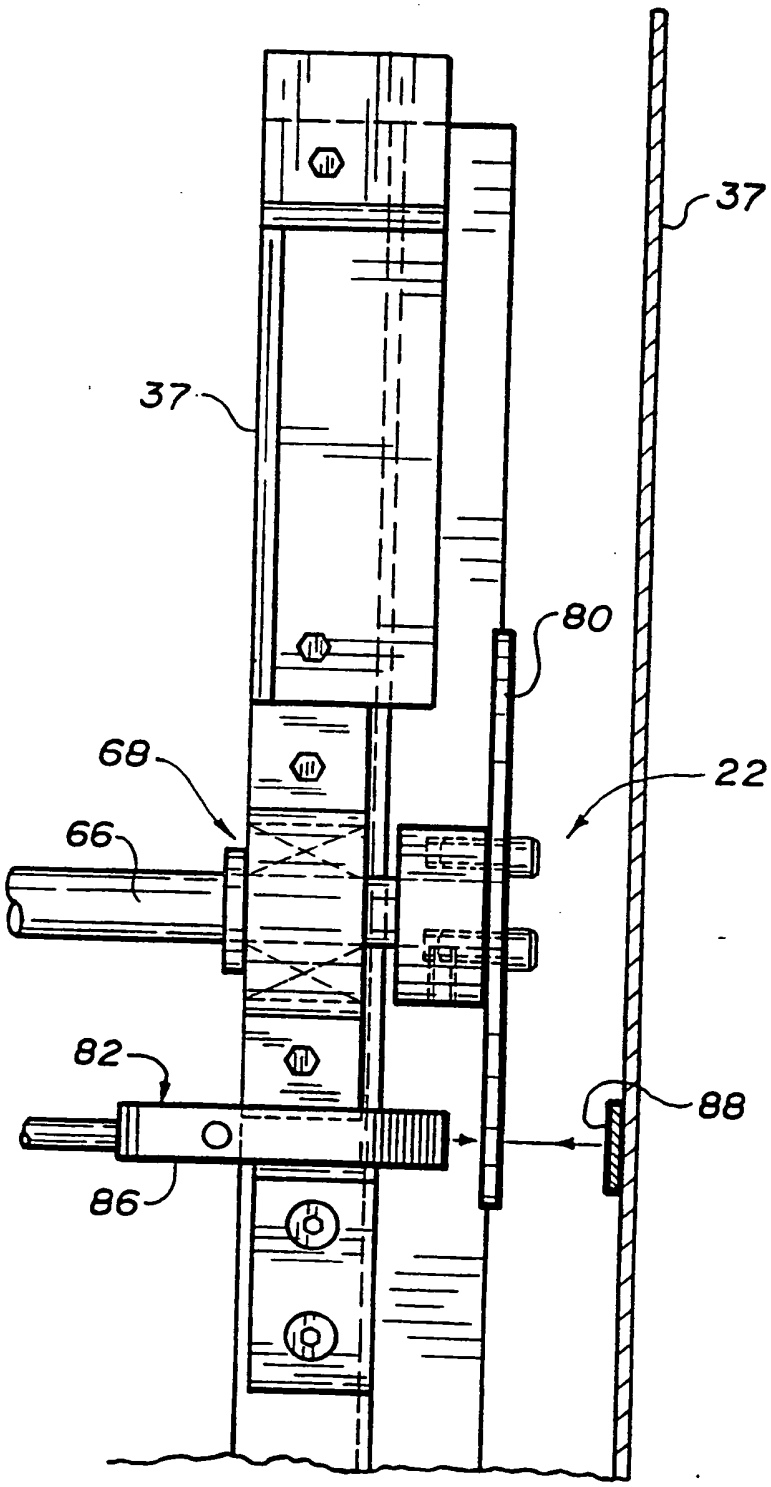


FIG. 2

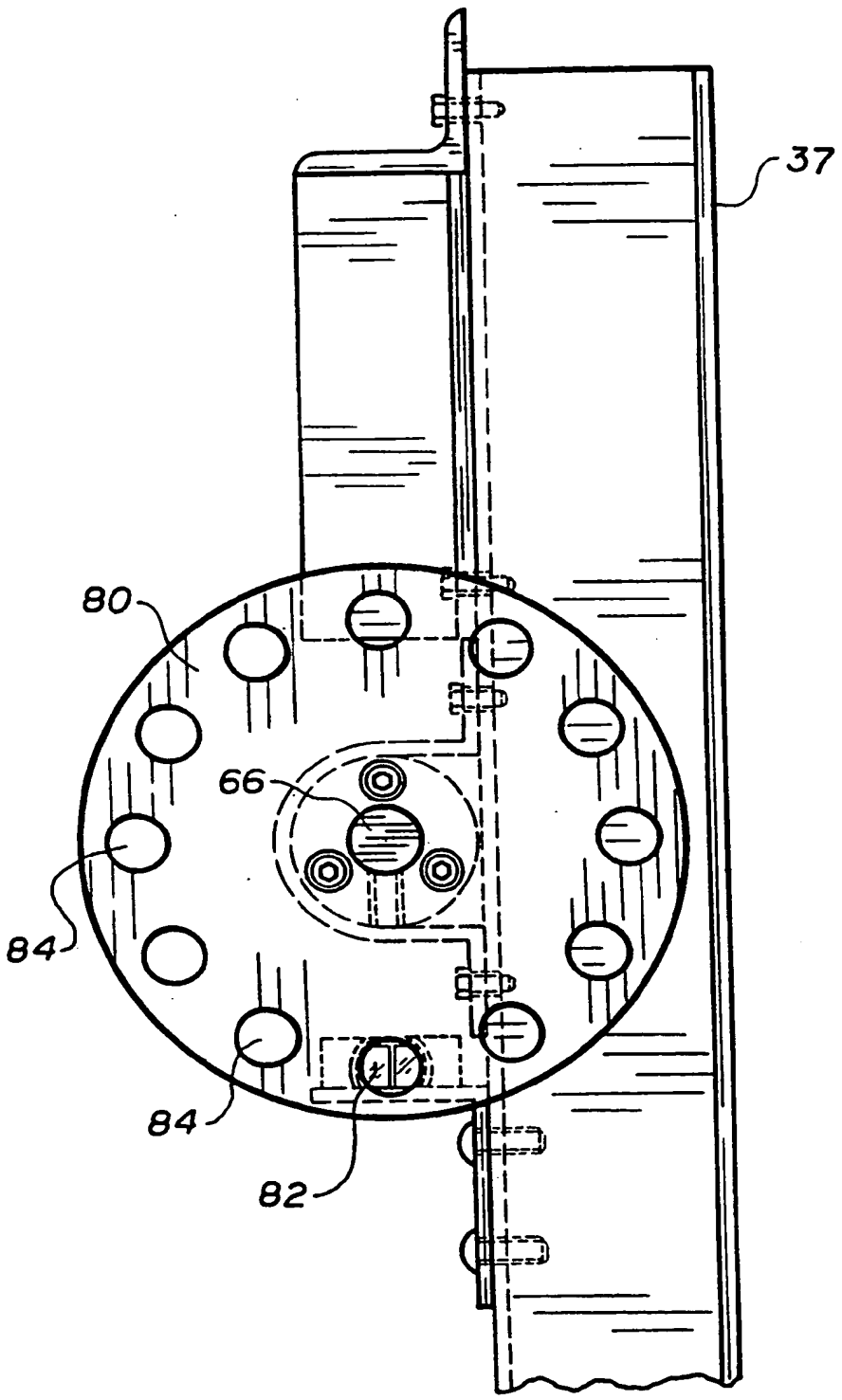


FIG. 3

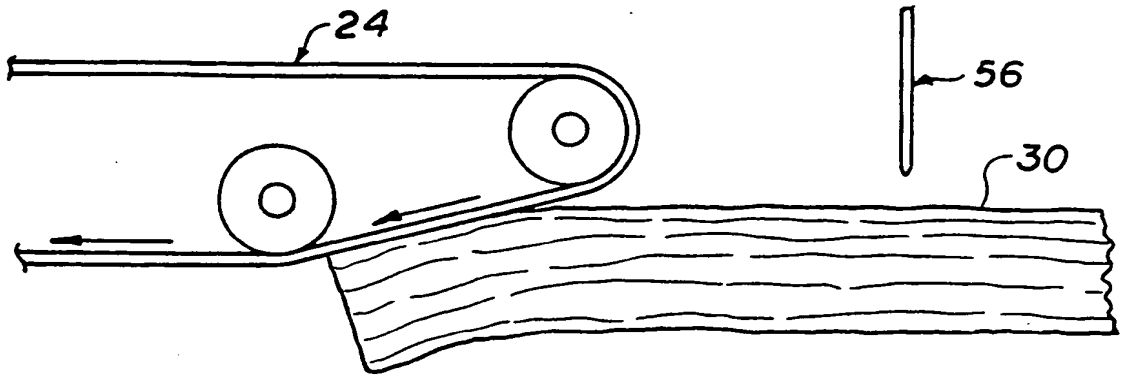


FIG. 4A

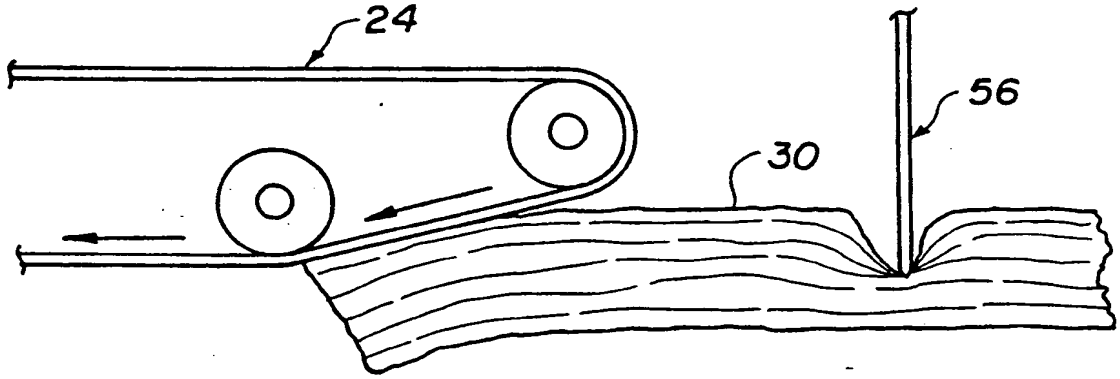


FIG. 4B

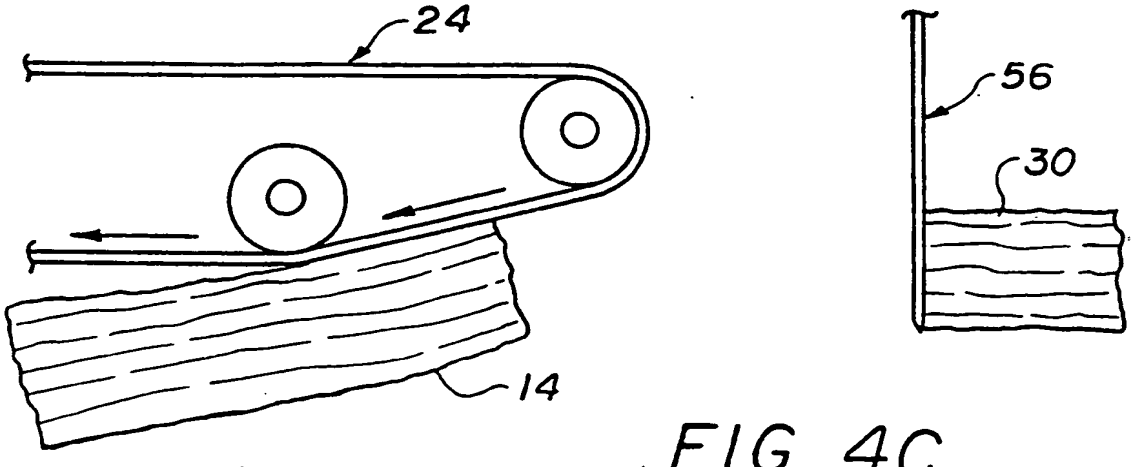
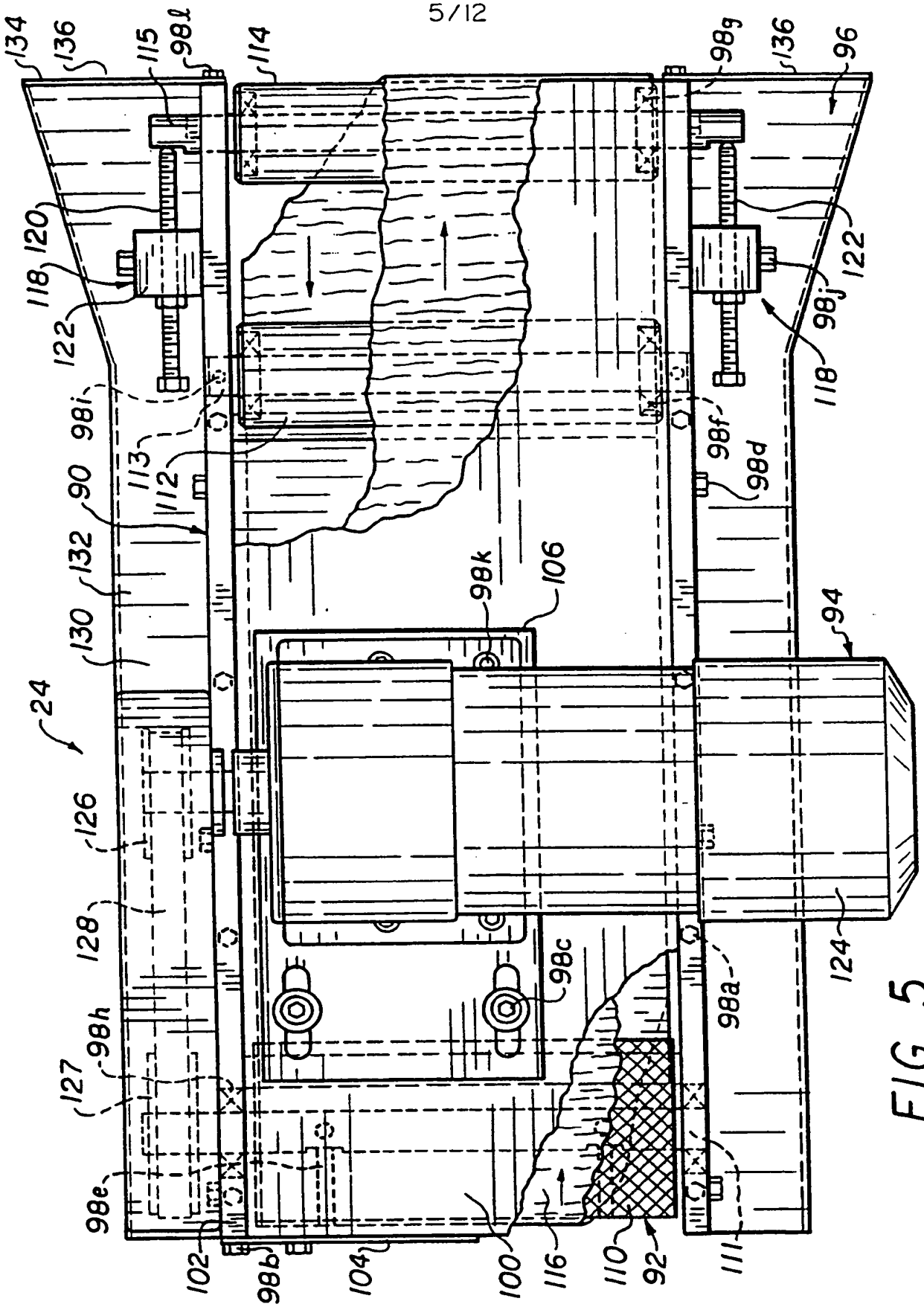


FIG. 4C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98k
106
130
94
24
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98b
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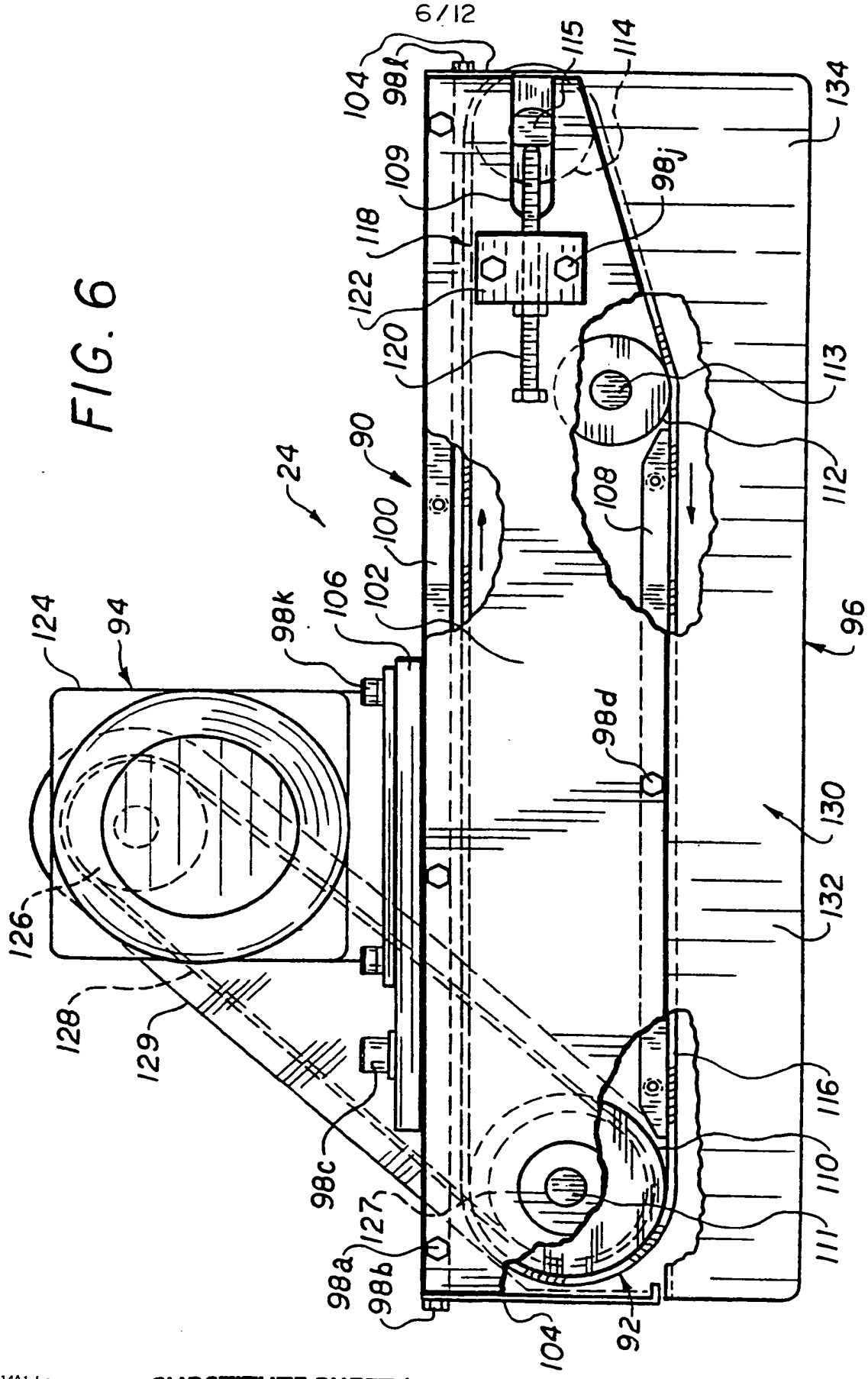
92
111

FIG. 5

FIG. 6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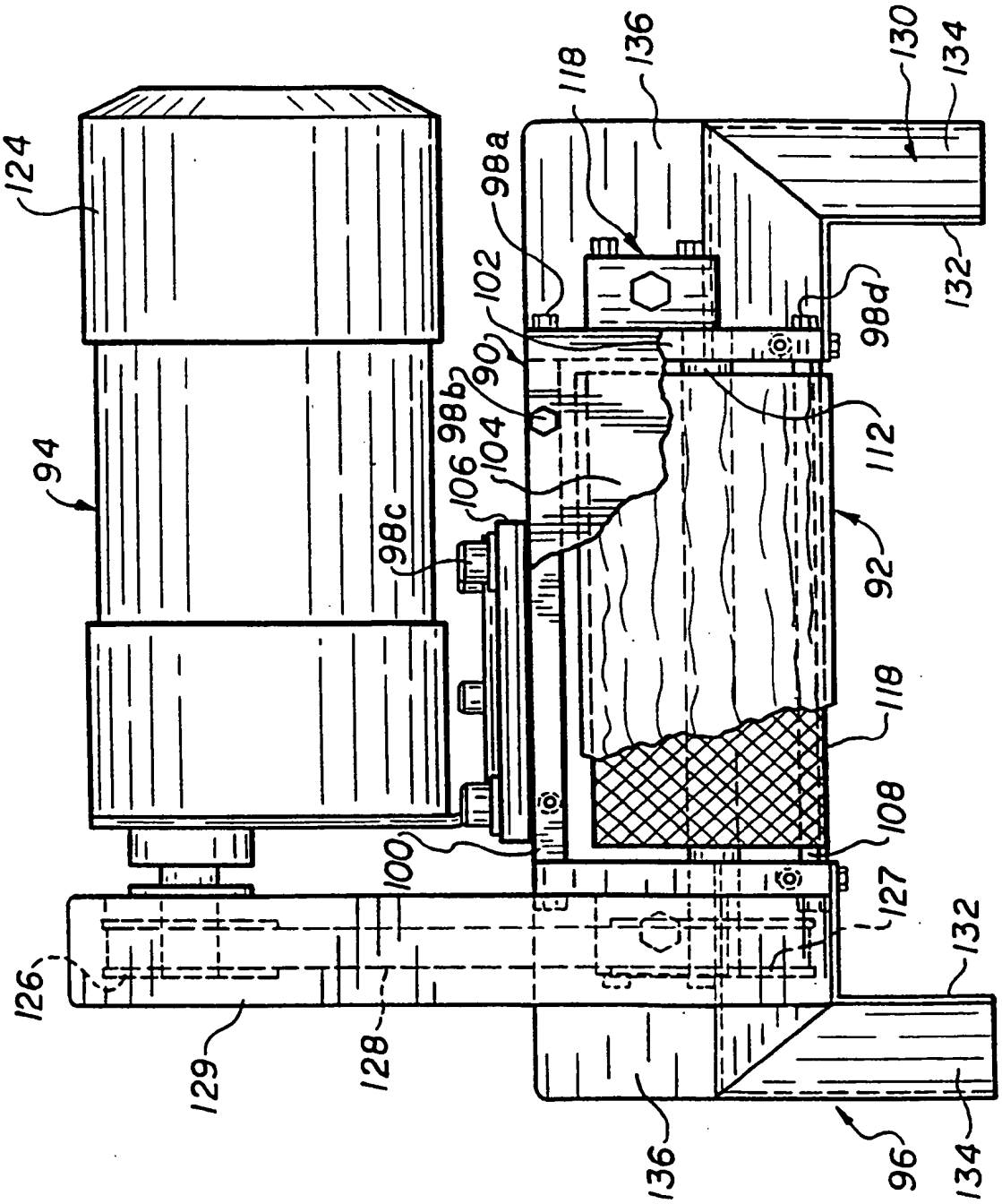
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129
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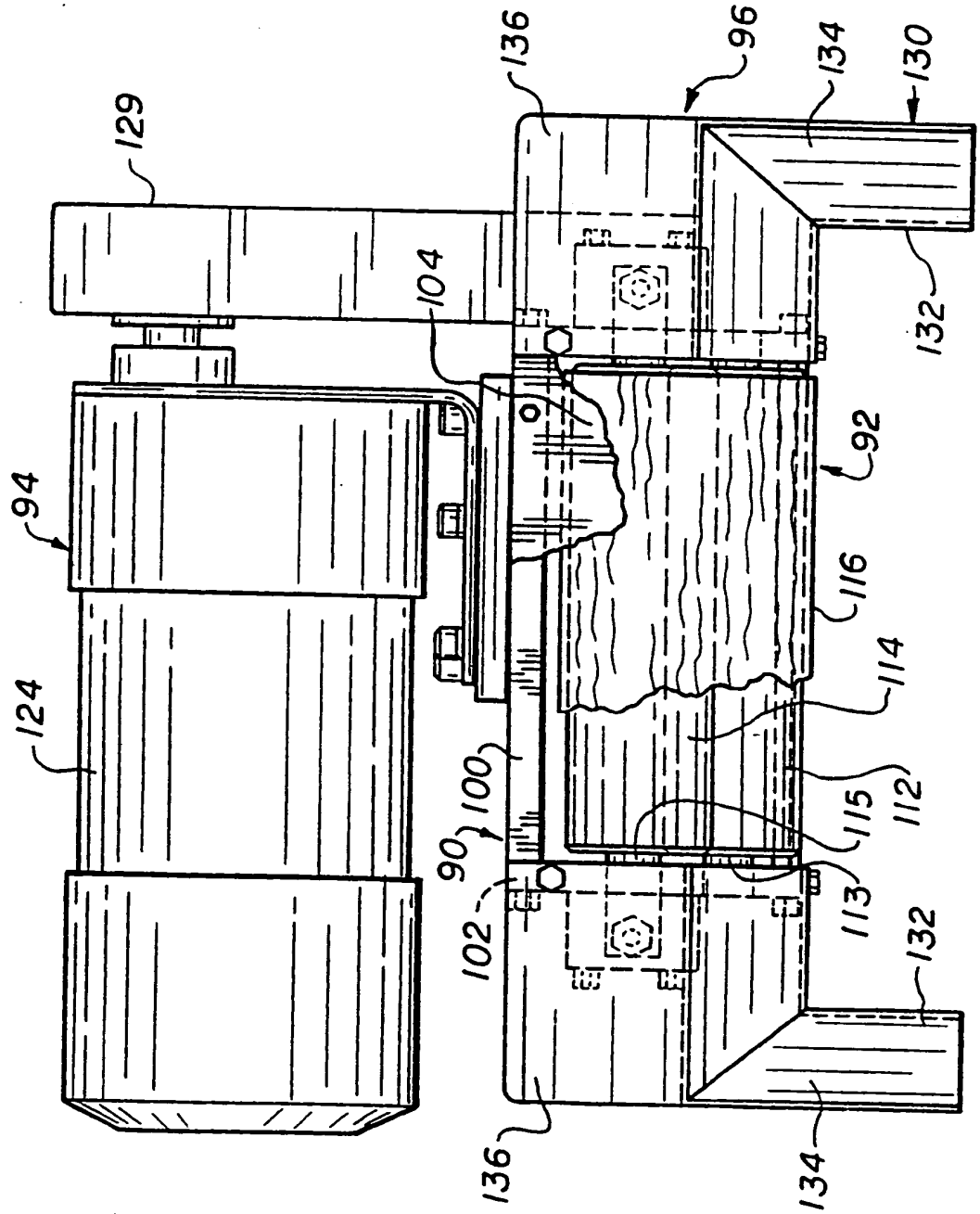
136
96
134

FIG. 7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132
136
134

FIG. 8

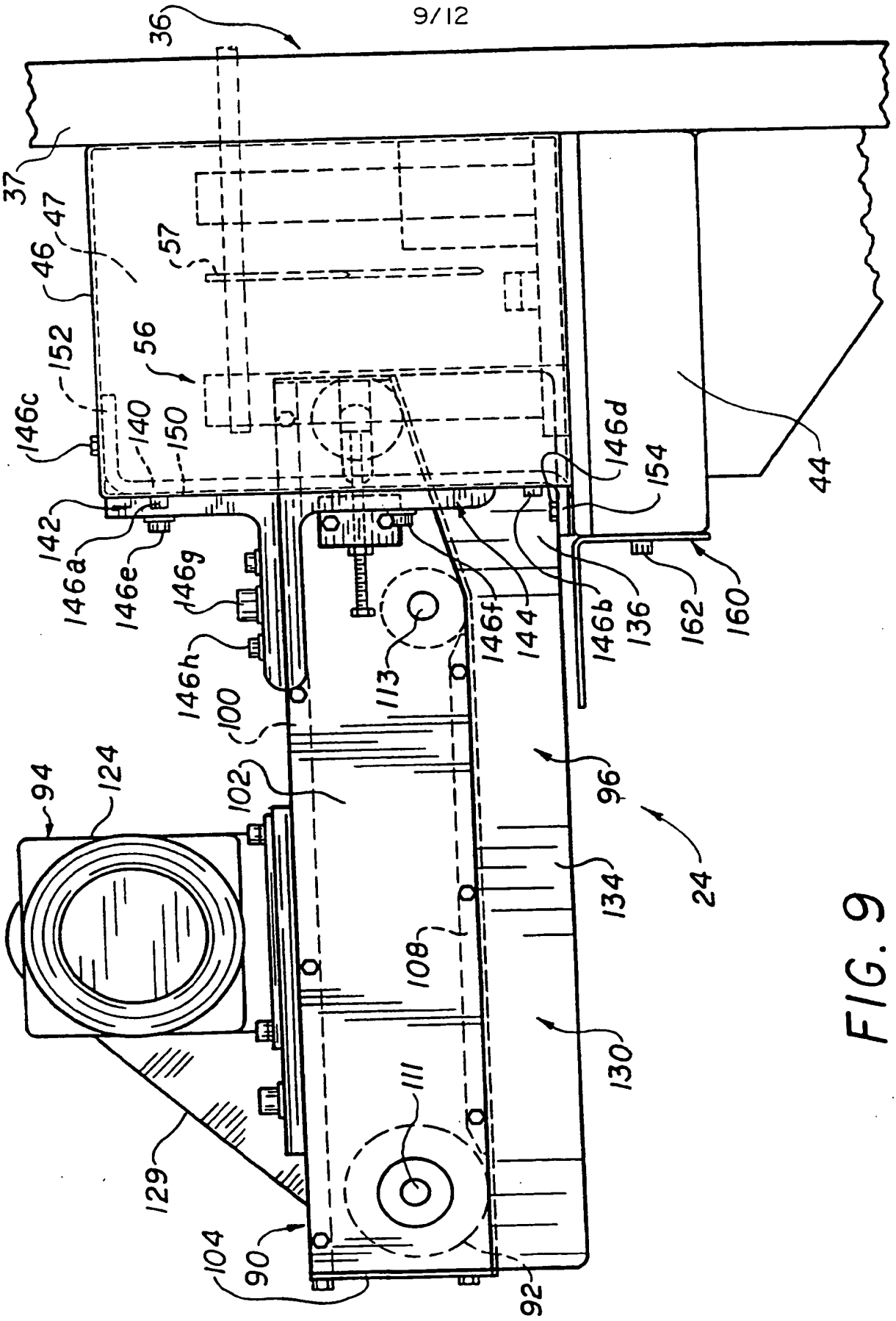
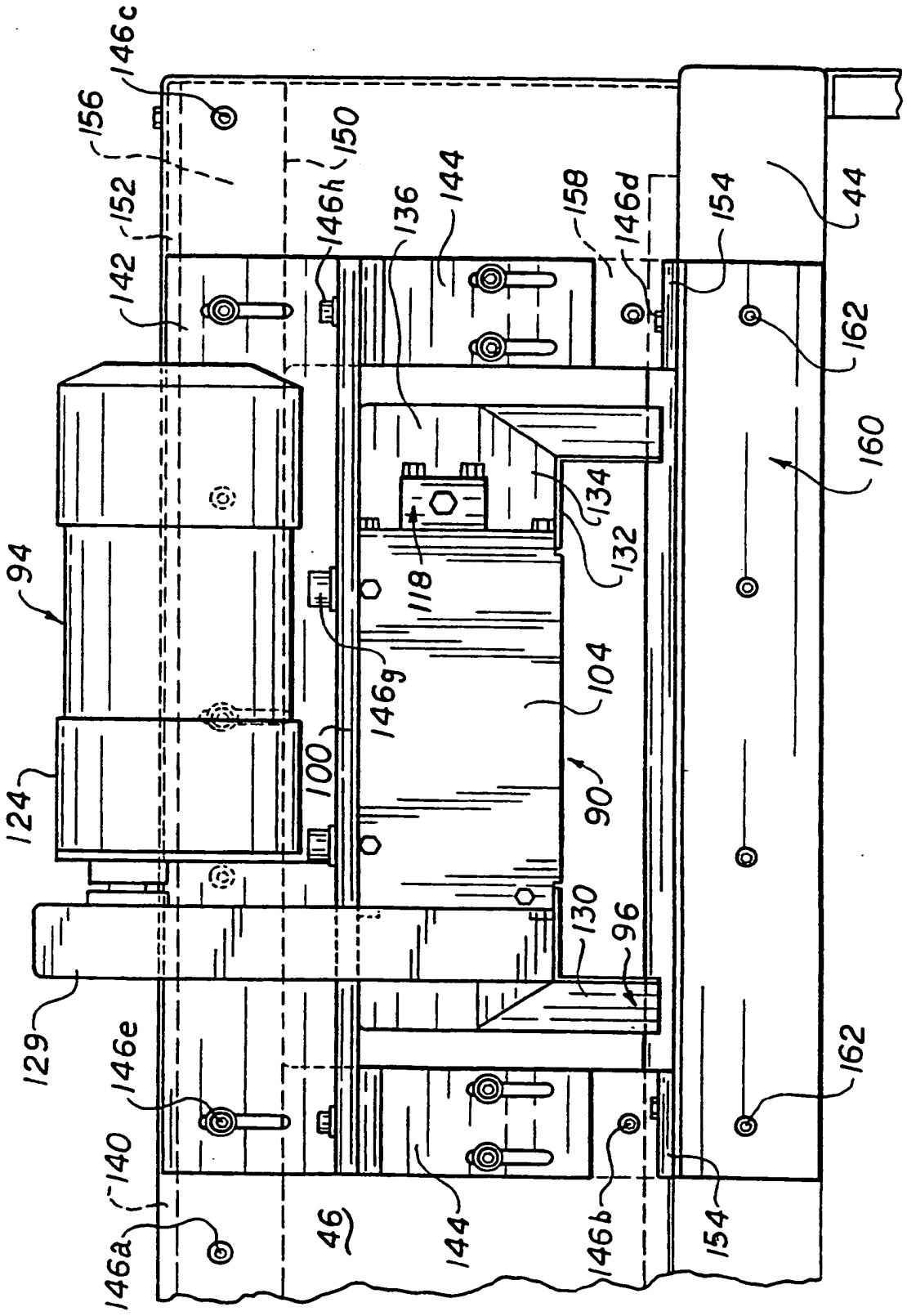


FIG. 9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150
152
146h
136
144
158
146d
154
44
142
162
160
134
132
118
94
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90
124
130
96
129
146e
162
140
154
46
144
146b
146a

FIG. 10

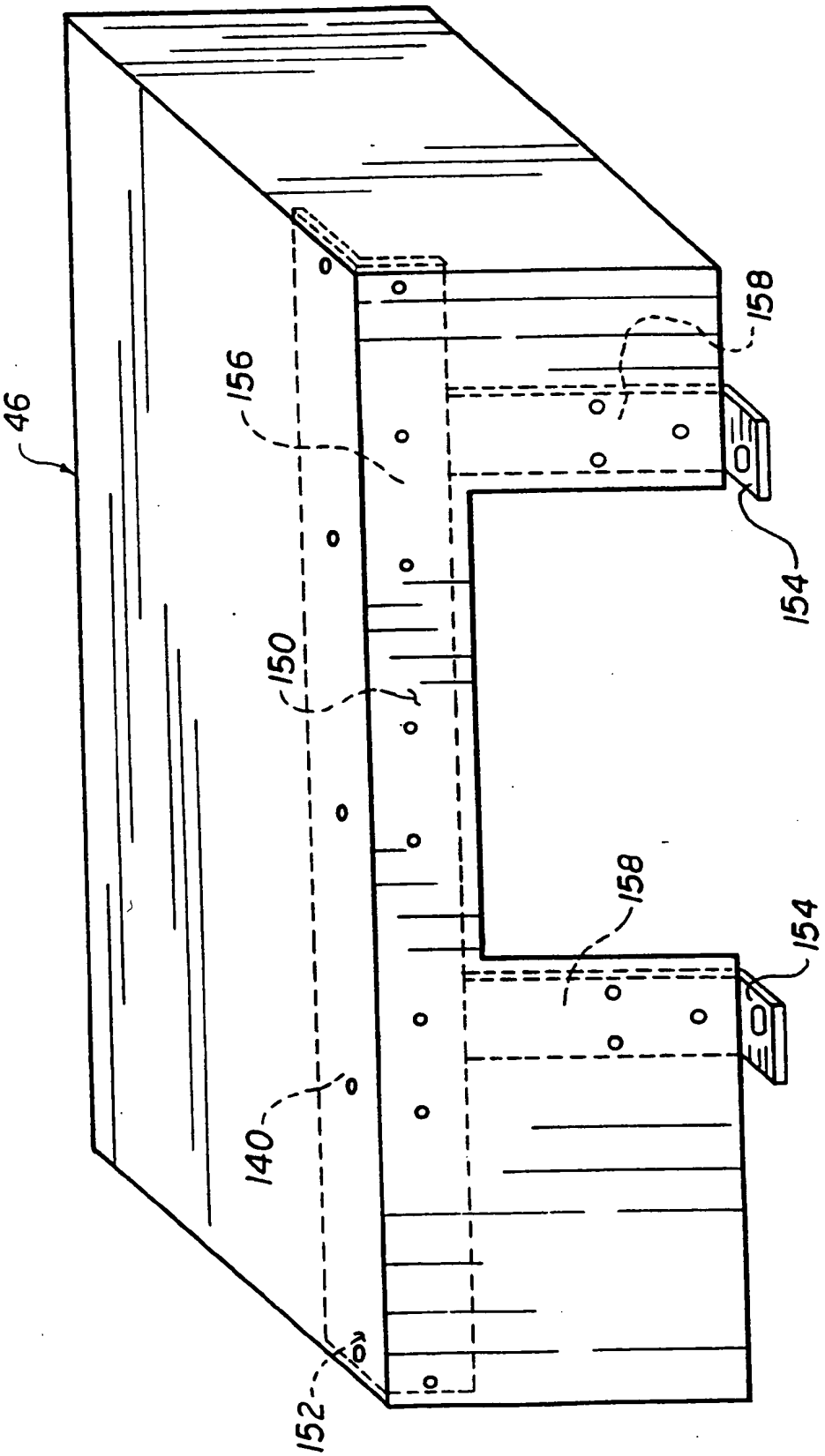

FIG. 11

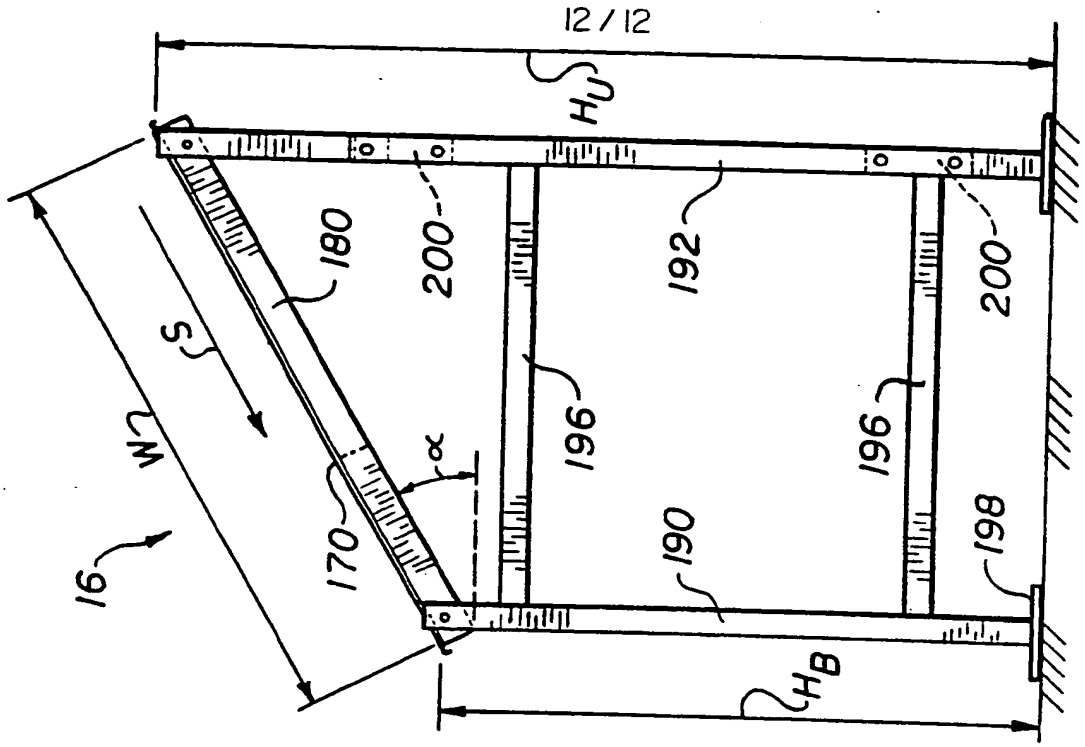

FIG. 13

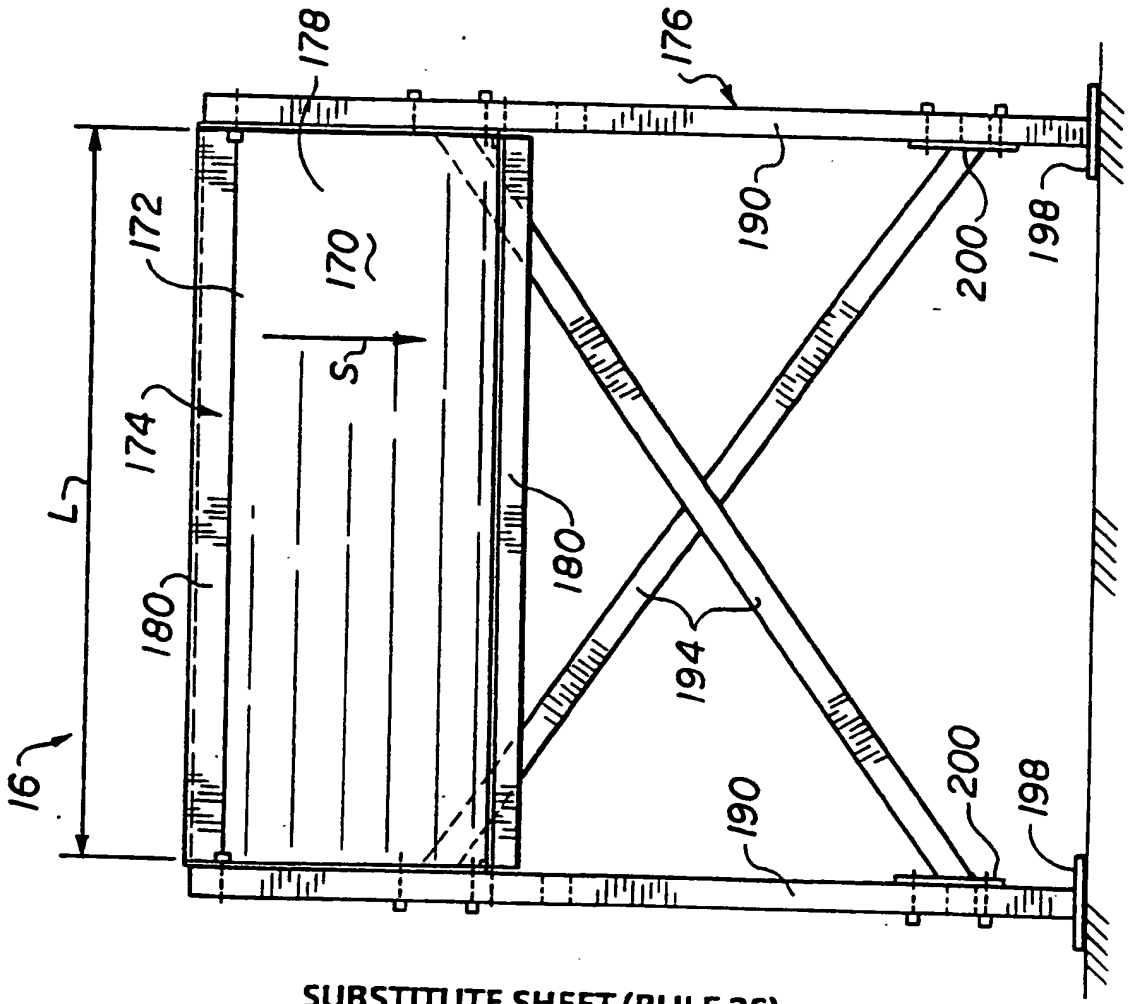

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/13380

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B31D 5/02; B31F 1/00; B26D 7/00,7/06; B65B 55/00
US CL : 493/352,967; 53/115; 83/165,167
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS: CUT, TRANSFER,TOP?,CHUTE,CONVEYOR,POST CUT CONVEYOR, PULL CONVEYOR, FRICTIONALLY ENGAGE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US, A, 3,509,797 (JOHNSON) 05 MAY 1970 SEE ENTIRE DOCUMENT	11-14, 16 --- 3, 15
Y	US, A, 5,123,889 (ARMINGTON ET AL) 23 JUNE 1992 SEE ENTIRE DOCUMENT	1-8, 10
Y	DD, A, 274188 (FASERB) 13 DECEMBER 1989 SEE ENTIRE DOCUMENT	1, 2, 5-8, 10
Y	US, A, 3,949,856 (ULBER ET AL) 13 APRIL 1976 SEE ENTIRE DOCUMENT	1-8, 10
Y	US, A, 4,557,716 (OTTAVIANO) 10 DECEMBER 1985 SEE ENTIRE DOCUMENT	15

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 09 JANUARY 1995	Date of mailing of the international search report 07 JAN 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer CHRISTOPHER DAY Telephone No. (703) 308-1148

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/13380

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 3,425,184 (HELIOT) 04 FEBRUARY 1969 SEE ENTIRE DOCUMENT	4, 17-21

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/13380

B. FIELDS SEARCHED
Minimum documentation searched
Classification System: U.S.

493/352,967,407,439,440,446,447,464; 53/117,115,118,520,155,238,390,522,513,153,255; 83/155,165,167;414/794.4,794.7,792.7